Claims

[1] A communication apparatus having a controlling unit for controlling assignment of channelization codes,

wherein the controlling unit comprises:

a code combination creating unit for creating a plurality of combinations of the channelization codes;

an inter-chip phase variation calculating unit for calculating each phase variation among a plurality of chips for each combination of the channelization codes created by the code combination creating unit;

a code combination determining unit for obtaining by calculation a combination of channelization codes of which a sum of overshoot generated by each phase variation among a plurality of chips calculated by the inter-chip phase variation calculating unit is small, and determining an obtained combination as a combination of codes to be used; and

a code assignment instructing unit for instructing assignment of the channelization codes based on the combination of codes determined by the code combination determining unit.

[2] The communication apparatus of claim 1, wherein

the inter-chip phase variation calculating unit obtains a phase variation between a first chip and a second chip and a phase variation between a third chip and a fourth chip, and

the code combination determining unit determines a combination of channelization codes of which the phase variation between the first chip and the second chip and the phase variation between the third chip and the fourth chip are respectively close to 0 degrees or 180 degrees as the combination of codes to be used.

[3] The communication apparatus of claim 1, wherein

the inter-chip phase variation calculating unit obtains a phase variation α between a first chip and a second chip of an I channel and a Q channel and a phase variation β between a third chip and a fourth chip of the I channel and the Q channel; and

the code combination determining unit determines a combination of channelization codes of which a sum of a square of sin(α) and a square of sin(β) is smallest as the combination of codes to be used.

[4] A communication apparatus comprising:

an IQ multiplexing unit for multiplexing a plurality of data channels and a control channel at an I side and a Q side to generate a complex signal;

a transmitting unit for modulating and transmitting the complex signal generated by the IQ multiplexing unit; and

a controlling unit for controlling assignment of channelization codes for a data channel and a control channel at the I side and the Q side multiplexed by the IQ multiplexing unit;

wherein the controlling unit comprises:

a code assigning unit by factor for, based on a size of a factor that is multiplied to the data channel and the control channel by the IQ multiplexing unit, assigning a first channelization code to a data channel of which the factor is large; and

a remaining code assigning unit for assigning a second channelization code being different from the first channelization code to a data channel to which no channelization code has been assigned by the code assigning unit by factor.

[5] The communication apparatus of claim 4, wherein

the code assigning unit by factor comprises a prohibited code judging unit for, when a second control channel is added as a control channel, judging which of the I side or the Q side of the IQ multiplexing unit the second control channel is added, and, at the I side or the Q side to which the second control channel is added, prohibiting assignment of a channelization code that has a correlation with a channelization code to be assigned to the second control channel.

[6] The communication apparatus of claim 4, wherein:

the factor is a gain factor; and

the controlling unit, when a number of data channels multiplexed by the IQ multiplexing unit is five, among three data channels at the I side of the IQ multiplexing unit, assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels

having largest gain factors and assigns either $C_{4,1}$ or $C_{4,0}$ to a remaining one data channel.

[7] The communication apparatus of claim 4, wherein:

the factor is a gain factor; and

the controlling unit, when a number of data channels multiplexed by the IQ multiplexing unit is six, among three data channels at the I side of the IQ multiplexing unit, assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels having largest gain factors and assigns $C_{4,1}$ to a remaining one data channel, and among three data channels at the Q side of the IQ multiplexing unit, assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels having largest gain factors and assigns either $C_{4,1}$ or $C_{4,0}$ to a remaining one data channel.

[8] The communication apparatus of claim 4, wherein

the controlling unit controls assignment of channelization code $C_{SF,k}$ of which a spreading factor is SF and a code number is k, assigns a channelization code of which the code number k is $0 \leqq k \leqq (SF/2-1)$ as the first channelization code, and assigns a channelization code of which the code number k is $(SF/2) \leqq k \leqq (SF-1)$ as the second channelization code.

[9] The communication apparatus of claim 4, wherein

the controlling unit controls assignment of channelization code $C_{SF,k}$ of which a spreading factor is SF and a code number is k, assigns a channelization code of which the code number k is $0 \leqq k \leqq (SF/2-1)$ as the second channelization code, and assigns a channelization code of which the code number k is $(SF/2) \leqq k \leqq (SF-1)$ as the first channelization code.

[10] The communication apparatus of claim 8, wherein

the controlling unit, in case of assigning channelization codes to a data channel of which the spreading factor SF is 2 and to a data channel of which the spreading factor SF is 4, assigns $C_{2,0}$ to the data channel of which the spreading factor SF is 2 as the first channelization code and assigns $C_{4,2}$ or $C_{4,3}$ to the data channel of which the spreading factor SF is 4 as the second channelization code.

[11] The communication apparatus of claim 9, wherein

the controlling unit, in case of assigning channelization codes to a data channel of which the spreading factor SF is 2 and to a data channel of which the spreading factor is 4, assigns $C_{2,1}$ to the data channel of which the spreading factor SF is 2 as the first channelization code and assigns $C_{4,0}$ or $C_{4,1}$ to the data channel of which the spreading factor SF is 4 as the second channelization code.

[12] A communication apparatus comprising:

an IQ multiplexing unit for multiplexing a plurality of data channels and a control channel at an I side and a Q side to generate a complex signal;

a transmitting unit for modulating and transmitting the complex signal generated by the IQ multiplexing unit; and

a controlling unit for controlling assignment of channelization codes for a data channel and a control channel at the I side and the Q side multiplexed by the IQ multiplexing unit;

wherein the controlling unit comprises:

a code assigning unit by data amount for, out of data channels multiplexed by the IQ multiplexing unit, judging a data channel of which data amount is large, and assigning a first channelization code to the data channel of which data amount is large; and

a remaining code assigning unit for assigning a second channelization code being different from the first channelization code to a data channel to which no channelization code has been assigned by the code assigning unit by data amount.

[13] The communication apparatus of claim 12, wherein

the code assigning unit by data amount comprises a prohibited code judging unit for, when a second control channel is added as a control channel, judging which of the I side or the Q side of the IQ multiplexing unit the second control channel is added, and, at the I side or the Q side to which the second control channel is added, prohibiting assignment of a channelization code that has a correlation with a channelization code which is to be assigned to the second control channel.

[14] The communication apparatus of claim 12, wherein

the code assigning unit by data amount, out of the plurality of data channels at

the I side and the Q side of the IQ multiplexing unit, judges a data channel of which a number of multiplexing is large as the data channel of which data amount is large rather than a data channel of which a number of multiplexing is small.

[15] The communication apparatus of claim 12, wherein

the controlling unit, when a number of data channels multiplexed by the IQ multiplexing unit is five, among three data channels at the I side of the IQ multiplexing unit, assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels having largest data amount, and assigns either $C_{4,1}$ or $C_{4,0}$ to a remaining one data channel, and assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels at the Q side of the IQ multiplexing unit.

[16] The communication apparatus of claim 12, wherein:

the controlling unit, when a number of data channels multiplexed by the IQ multiplexing unit is six, among three data channels at the I side of the IQ multiplexing unit, assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels having largest data amount, and assigns either $C_{4,1}$ or $C_{4,0}$ to a remaining one data channel, and among three data channels at the Q side of the IQ multiplexing unit, assigns $C_{4,2}$ and $C_{4,3}$ respectively as channelization codes to two data channels having largest data amount and assigns $C_{4,1}$ to a remaining one data channel.